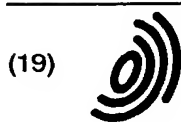


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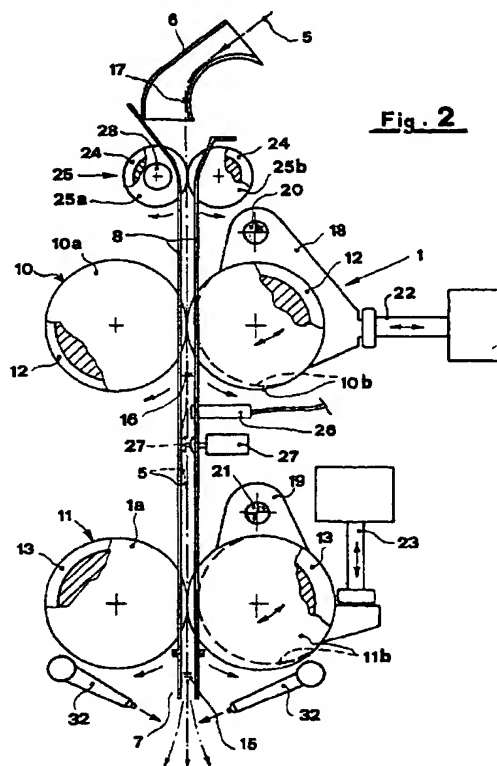
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(54) **Method for tearing printed paper fed in a continuous strip without lateral dragging holes and respective tearing and folding apparatus**

(57) Tearing and folding apparatus for printed paper fed in a continuous strip comprising a device (1) for tearing the paper (5) along transversal perforations (15,16,17) by means of passing through two pair of rollers (10,11) rotating at different speeds. A third pair of friction rollers (25) provides for the dragging of the paper (5) and for the measurement of the advancement of the paper itself by means of an encoder (28). A sensor (26) communicates the passage of a transversal perforation (15) preceding the one to be torn (16) and, in that instant, begins the measurement of the linear development of the paper in order to allow for the closing of the pairs of rollers (10,11) so that the transversal perforation (16) is located between them.



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Description

The present invention relates to the field of printers, paper processing apparatuses and the like and, more precisely, it relates to a method for tearing paper fed in a continuous strip without lateral dragging holes. Furthermore, the invention relates to improvements in a tearing and folding apparatus for said paper in correspondence with transversal perforations.

Printers or paper processing apparatuses of medium and large dimensions are normally fed by a continuous strip of paper. At their outputs, the paper is normally in single, separate sheets or in the form of a continuous strip of sheets divided by transversal perforations suited to facilitate tearing and, therefore, separation of the sheets at a later time. In the case of paper exiting in a continuous form, downstream from said printers or paper processing apparatuses, means are provided for the collection of the paper into packages which are then withdrawn automatically or manually. These means for collection of the paper into packages, in some cases, are machines comprising tearing means, folding means and means for the conveying the packages formed.

More precisely, the means for tearing the paper operates each time a package is completed, and every package is formed, for example, as shown in Italian patent application no.22536A/88 in the name of the same applicant. The packages formed are then, contemporaneously with the tearing, automatically removed by means of pushers and conveyor belts.

The type of paper used for this type of operation up to this time has been in the form of a continuous strip with lateral dragging holes which engage in "paper-dragging" rollers, comprising radial teeth and located in various points of the paper path. The presence of the paper-dragging rollers enormously facilitates the control of the position of the paper since the lateral holes are equidistant from one another and, therefore, the linear position of the paper can be known in any point of the printer. A further advantage coming from the use of this kind of paper is that, if printers comprising paper-dragging rollers operated with paper which, rather than being taut, formed a loop between two consecutive paper-dragging rollers, the control of the paper would not be compromised in the least.

The tearing step is also facilitated by the presence of the respective paper-dragging rollers which, by means of a simple encoder, allow for the calculation of the position of the transversal perforations and, therefore, for the tearing along the separating line of the two consecutive packages. This tear, in a widely used printer of that kind, occurs by means of the passage of the paper through two pairs of pinch rollers, the first pair rotating at a lower peripheral velocity than the second at the time of tearing. The different speed causes a great instantaneous tensile stress on the line of perforation and thus produces an immediate separation of the two consecutive sheets.

The presence of dragging holes requires, however, at the input of the printers, the use of pre-processed reels of paper, i.e. already provided with dragging holes, consequently increasing the cost of the paper. For this reason, currently, the tendency is to try to use, at the input of printers and other paper processing apparatuses, virgin continuous strips of paper purchased directly from the mill without lateral dragging holes. However, with this type of paper, checking the position of the paper is more difficult since contact between the paper and the dragging means occurs under friction with taut paper, with the possibility of errors that can accumulate over time. Thus, also in the case of the tearing means of the paper, it is currently difficult to overcome this drawback, which can involve errors in closing the pairs of tearing rollers in synchronism with the passage of a perforated line between them. In fact, since the paper advances at a high speed, it is necessary for said synchronism to be rigorously respected in order to allow the paper to have a sufficient tension and tear before the perforated line reaches the second pair of rollers.

The object of the present invention is to provide a method for the tearing, along transversal perforations, of paper fed in a continuous form without lateral dragging holes, able to assure a precise tear even with paper advancing at a high velocity.

A further object of the present invention is to provide improvements in a tearing and folding apparatus for continuously fed paper, for example pre-printed paper, suitable to allow the tearing of the paper at high speeds even if it does not have dragging holes along the lateral edges.

These objects are accomplished by the tearing method and the improvements in a tearing and folding apparatus for continuously fed paper according to the present invention. The method comprises the steps of:

- reading the position of a transversal perforation preceding the one to be torn as it passes between the two pairs of tearing rollers;
- measurement of the linear extension of the paper crossing the pairs of rollers starting from said reading;
- calculation of the position of a subsequent perforation on the basis of said measurement;
- closing of the pairs of rollers on said paper in order to tear it when said position of the subsequent perforation is calculated to be between the two pairs of rollers. In this way, the possibility of errors in the calculation of the instant of closing of the pairs of tearing rollers caused by the slipping of the paper is prevented.

The tearing and folding apparatus, which also comprises a first and a second pair of tearing rollers, as well as a third pair of dragging rollers, is provided with improvements according to the invention, the novel feature of which is that the rollers of the third pair are friction rollers and their rotation speed is measured by an encoder provided on one of them and communicating

with a processing unit. A sensor is provided communicating with the processing unit to detect the passage of a transversal perforation preceding the perforation to be torn, whereby the processing unit can operate the closing of the first and second pairs of rollers on the paper when the subsequent perforation is in the position to be torn.

Further characteristics and advantages of the tearing method and improvements in a tearing and folding apparatus according to the present invention will be made apparent in the description which follows of one of their possible embodiments, given as an example but not limitative, with reference to the attached drawings in which:

- figure 1 is a partial sectional elevational view of a paper tearing and folding apparatus with the device according to the invention;
- figure 2 is a diagrammatic elevational view of an improved paper-tearing device according to the invention;
- figure 3 is a diagrammatic view of the logical connections between a processing unit and the device of figure 2.

With reference to figure 1, a tearing and folding apparatus for continuously printed paper is shown, for example of the type described in patent application no. 22536A/88 in the name of the same applicant, comprising a paper-tearing device 1 and a pair of folding rollers 2 and 3 suited to form a package 4. Once the package is complete, device 1 provides for the tearing of the strip of paper 5 in correspondence with a transversal line of perforations already formed on the paper. At the same time, package 4 is carried away by removing means not shown because they are of a known type, for example a pneumatic pusher or a conveyor belt.

Paper-tearing device 1 is illustrated in figure 2 and comprises an input funnel 6 and an output guide formed by two parallel plates 7 accompanying strip 5 of paper in order to facilitate folding. Between input funnel 6 and output guide 7 a double grate 8 for guiding the paper between a first pair of rollers 10 and a second pair of rollers 11 is provided for. The rollers of pairs 10 and 11 are pinch-rolls and the rollers of the second pair 11 have a speed about 30% faster than that of the first pair 10. On rollers 10 and 11, respectively grooves 12 and 13 are formed which allow for the insertion of grate 8 guiding paper 5. On said paper, successive transversal perforations are formed and three of them, indicated schematically with 15, 16 and 17 are shown in figure 2.

The rollers of pair 10 and pair 11 comprise, respectively, fixed rollers 10a and 11a and mobile rollers 10b and 11b, the latter being mounted respectively on supports 18 and 19 which are rotatable with respect to fixed pivots 20 and 21 when set into motion by respective actuators 22 and 23.

In conditions of normal advancement of the paper, which is being folded into a package, rollers 10b and 11b

are in an open position, illustrated with a dashed line, allowing for free sliding advancement of the paper conveyed by means of a third pair of dragging rollers 25 with roller 25b motorised and roller 25a in neutral, rotating as a result of the friction contact on roller 25b, and both provided with grooves 24 for the passage of grate 8.

According to the invention, on roller 25a, an encoder 28 is provided for which measures the linear development of paper 5 and communicates the data measured to a central processing unit 30, illustrated schematically in figure 3. Furthermore, an optical sensor 26 to detect the passage of a transversal perforation of paper 5 is provided for along with a small pusher piston 27 suited to create a flexure in paper 5 between the two pairs of rollers 10 and 11, as can be seen in the position illustrated with a dashed line. Also sensor 26 and piston 27 are connected to processing unit 30 (fig. 3) which is also connected with actuators 22 and 23.

In order to facilitate the detection and reading of the position of the transversal perforations 15, 16, 17 by sensor 27, normally, notches are provided on the edges of each sheet of paper 5 in proximity to the transversal perforations themselves and easily identifiable since they are generally formed in a dark colour, contrasting with the light background of the paper. The length of each sheet, delimited by two consecutive perforations, is already recorded in processing unit 30 or it is communicated to it by a sensor or encoder 31 located in an apparatus upstream from the device 1, connected for example to a transversal perforating device or to an additional optic sensor combined with an encoder at the input. In figure 2, air jets 32 are also shown suited to direct the paper immediately after being torn in order to facilitate folding.

With reference to figure 2, having to produce a tear in correspondence with perforation 16 or 17, device 1 operates as follows. First of all, the signal for tearing is given by the processing unit on the basis of the linear development of paper 5 or, alternatively, by means of a bar-code located on the border of a sheet preceding the perforation line along which the tear must be performed, said bar-code being read by a sensor not shown. Subsequently, sensor 26 detects the passage of perforation 15 and begins from that instant the measurement of the length of the sheet existing between perforation 15 and perforation 16 by means of encoder 28. This operation is possible because paper 5 is taut between rollers 25 and sensor 26. The tear signal is given when processing unit 30 has calculated that the position of the perforation 16 is immediately downstream from rollers 10. The tearing signal causes the closing of rollers 10b and 11b on rollers 10a and 11a and the advancement of piston 27. As already stated above, the difference in speed between rollers 11 and rollers 10 creates tensile stress in the paper comprised between them and the tearing is also favoured by the pushing of piston 27 which initiates the tearing of the paper at perforation 16.

If the tear were to be carried out at perforation 17 instead of perforation 16, the calculation of the length starting from perforation 15 would be carried out twice.

The improvements according to the invention allow for the carrying out of the tearing of paper 5 without the necessity for lateral dragging holes in the same. The problem of possible sliding of the paper which could occur between rollers 24a and 24b and cause an error in the calculation of the position of the transversal perforations which would accumulate over time, is overcome by the presence of optic sensor 26 which allows for the zeroing of the calculation of that position before each tearing operation. Any possible sliding that could occur between the reading of the position of perforation 15 and the moment of tearing along perforation 16 or 17 would be entirely negligible since, even if the speed of the paper is high (50-100 cm/sec and even higher) such an error would be less than one tenth of a millimetre. Furthermore, the presence of piston 27 favours the initiation of the tear overcoming the inconvenience which sometimes occurs in apparatuses of a known type which leads in some cases to lacerations of the paper outside the line of perforation or to failure to tear the paper.

Variations and/or modifications can be brought to the improvements in a tearing and folding apparatus according to the invention without departing from the scope of the invention itself.

Claims

1. Improvements in an apparatus for tearing and folding printed paper fed in a continuous strip, said paper having transversal perforations to facilitate tearing and side edges without dragging holes, said apparatus comprising

- a first and a second pair of rollers at least one of which is motorised,
- a guide for said paper between said first and second pair of rollers
- actuating means pushing said first and second pair of rollers, upon signal from a processing unit, to grip said paper only in a tearing step, said step being caused by different speeds of said first and second pairs of rollers
- a third pair of rollers dragging said paper between said rollers,

characterised in that the rollers of said third pair are of a friction type and an encoder is provided on one of them measuring their speed and communicating with said processing unit; a sensor detecting said perforations and communicating with said processing unit being provided, said processing unit operating the pushing together of said first and second pairs of rollers to close on said paper when said perforation is calculated being in a position interposed between them.

2. Improvements according to claim 1, wherein said paper, in correspondence with said transversal perforations, has reference notches detectable by said sensor.

3. Improvements according to claim 1, wherein said sensor is interposed between said first and said second pair of rollers.

4. Improvements according to claim 1, wherein said third pair of rollers comprises a first roller set in rotation in synchronism with said first pair of rollers and a second roller in friction contact with said first roller, said encoder being mounted on the rotational axis of said second roller.

5. Improvements according to claim 1, wherein a pusher piston is provided located between said first and said second pair of rollers and working in synchronism with the closing of the second pair of rollers to press orthogonally against said paper, whereby the initiation of tearing along said transversal perforation is facilitated.

6. Method for the tearing of paper, for example printed and continuously fed, said paper being in the form of a continuous strip without lateral dragging holes and comprising transversal perforations delimiting two consecutive sheets, comprising the following steps of:

- dragging the paper by means of a first and second pair of rollers with the rollers of each pair not in contact with one another,
- closing of said first and second pair of rollers on said paper when one of said transversal perforations, along which tearing between two consecutive sheets is to be carried out, reaches a position between said pairs of rollers, said second pair of rollers moving at a greater speed than the first pair,

characterised in that said position of said perforation along which the tearing of the paper is to be carried out is measured by means of:

- reading of the position of a perforation preceding the one which is to be torn along as it passes between said pairs of rollers,
- measurement of the linear extension of said paper crossing the pairs of rollers starting from said reading,
- calculation of the position of a subsequent perforation on the basis of said measurement,
- closing of said pairs of rollers on said paper to tear it when said position of said subsequent perforation is calculated to be between said pairs of rollers.

Fig. 1

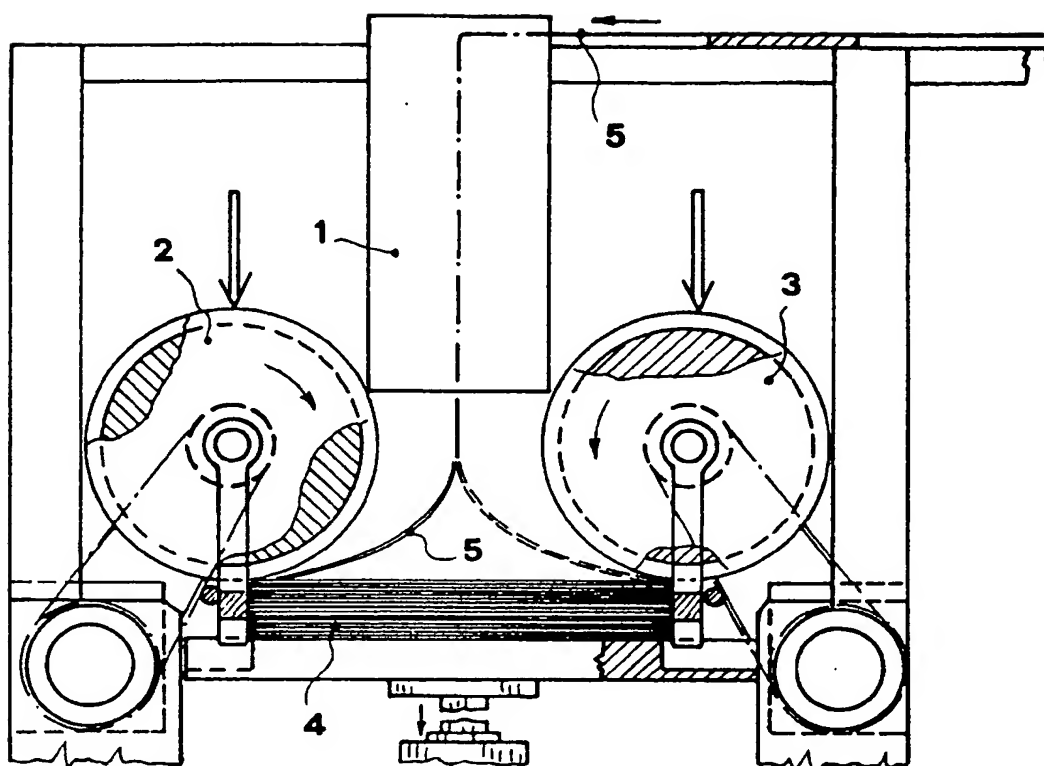


Fig. 3

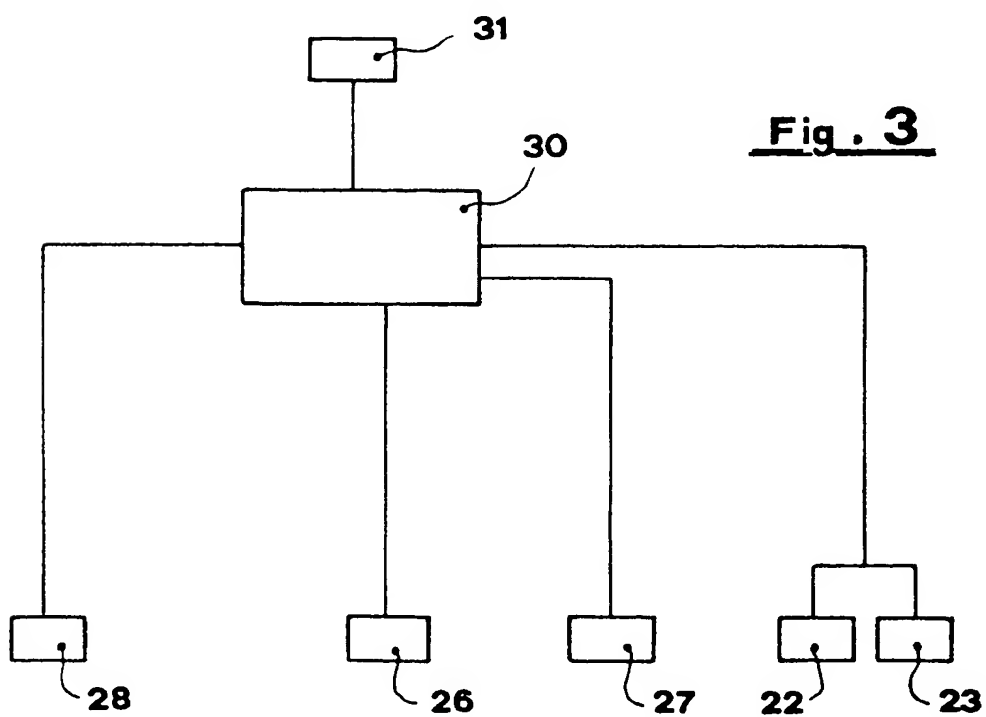
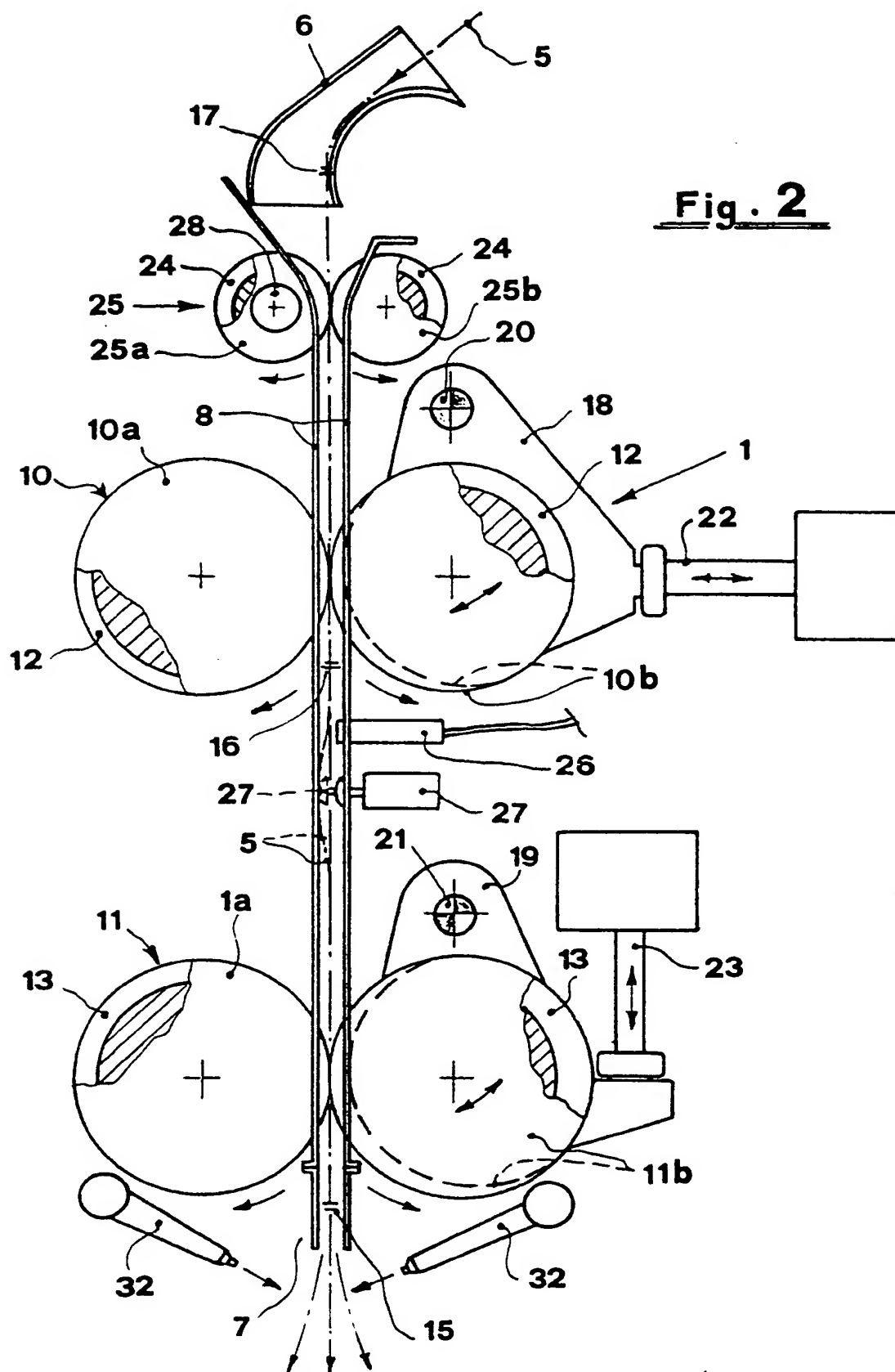


Fig. 2





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EUROPEAN SEARCH REPORT

Application Number
EP 94 83 0571

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.CL.6)
Y	DE-A-32 05 801 (BÖWE MASCHINENFABRIK GMBH) * the whole document *	1-3,6	B65H35/10
Y	FR-A-2 624 490 (MARTIN G.) * page 6, line 32 - page 8, line 15; figures 1,2 *	1,2	
Y	PATENT ABSTRACTS OF JAPAN vol. 18, no. 119 (M-1567) 25 February 1994 & JP-A-05 310 360 (ISETO SHIKO KK) 22 November 1993 * abstract *	3,6	
A	DE-B-12 31 100 (TILGER E.) * column 4, line 28 - line 34 *	4	
A	EP-A-0 479 385 (INDUSTRIA GRAPHICA MESCHI S.R.L.) * column 7, line 36 - column 8, line 22 *	5	
A	PATENT ABSTRACTS OF JAPAN vol. 18, no. 335 (M-1627) 24 June 1994 & JP-A-06 079 700 (TOSHIBA SEIKI KK) 22 March 1994 * abstract *		TECHNICAL FIELDS SEARCHED (Int.CL.6)
			B65H
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		10 May 1995	Thibaut, E
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